Kurz

A study of the relationship between
interest and achievement in air
technical training in the Navy.

THESIS
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A STUDY OF THE RELATIONSHIP BETWEEN INTEREST AND ACHIEVEMENT IN AIR TECHNICAL TRAINING IN THE NAVY

Abstract of

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Presented in Partial Fulfillment of the Requirements
for the Degree Master of Arts

By

LLOYD ALLEN KURZ, B.A.

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A STUDY OF THE RELATIONSHIP BETWEEN INTEREST AND ACHIEVEMENT IN AIR TECHNICAL TRAINING IN THE NAVY

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The primary purpose of this study was to determine the relationship between interest as measured by the *Minnesota Vocational Interest Inventory* and achievement in air technical training in the Navy. A secondary aim was to determine the relationship between the subjects' interest in the Navy rating for which they were in training and ability as measured by the Navy General Classification test, and the relationship between interest and mechanical aptitude as measured by the Navy Mechanical Aptitude test.

The interest inventory was administered to eight hundred nineteen enlisted personnel in the Aviation Electronics Technician and Electronicsman school and the Aviation Machinist's Mates school at the Air Technical Training Command, Memphis, Tennessee. To determine the interest-achievement relationship, ability was held constant.

For men of the same ability, interest scores were correlated with final averages. Interest scores were also correlated with ability scores and mechanical aptitude scores.

The following conclusions were made from the results which were obtained:

1. There appears to be a relationship between interest and achievement in air technical training in the Navy. The relationship is positive and significant.

2. It appears that prediction of success in an air technical training course can be improved by the possession of knowledge of a man's interest in a Navy occupation.

3. Measured interests of naval air technical training students seem to have no significant relationship with ability to learn.

4. The measured interests of aviation electronics school trainees do not correlate significantly with mechanical aptitude. The measured interests of aviation machinist school trainees tend to have a small but significant relationship with mechanical aptitude.

5. Men who are in air technical training schools appear to have interests in the rating for which they are in training that are similar to the interests of experienced men in those ratings.

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CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

The primary purpose of this study was to determine the relationship between interest and achievement in air technical training in the Navy. A secondary aim was to determine the relationship of the subjects' interest in the rating for which they were in training with certain factors which are utilized in classification and selection for aviation technical training.

The Relationship Between Interest and Achievement

Strong (51) has stated that "the relationships among abilities, interests, and achievements may be likened to a motor boat with a motor and a rudder. The motor (abilities) determines how fast the boat can go, the rudder (interests) determines which way the boat goes. Achievement may be thought of as the distance traveled in a straight line in a given interval of time, resulting from operation of both motor and rudder."

Wyman (65), in a study of genius in children, concluded, "Intellectual interest is a very potent factor in determining achievement. But the question arises, must a

child be interested in what he is doing in order to achieve success in it, or is it the ability to succeed that gives the interest? In which direction does the causal relation lie? We find that the most successful child is highly intelligent and highly interested. Some children who are not highly interested have succeeded, but they are highly intelligent. Again, some highly intelligent, but not highly interested, have not succeeded; and, finally, some with lower intelligence and not a high degree of success are highly interested. The answer to the question, then, is that a child must be interested to achieve success, the greater the interest and the higher the intelligence, the greater the success ..., and not that ability to succeed produces the interest." The foregoing suggested the hypothesis that if two men of equal ability entered a technical training course for a naval occupation, and if their degree of interest in that occupation was not equal, then their degree of achievement in the training would differ in accordance with their degree of interest.

The Importance of Determining the Relationship

There is general agreement that prediction cannot safely be made of success either in a school subject or in subsequent employment on the basis of high interest scores

alone. This, of course, does not mean that interest may not be an important factor in scholastic achievement and occupational success. Hubbard (40) concluded that "interest and abilities seem to be independent variables, each one contributing its own quota to the ultimate success." It seemed that information regarding a man's interests combined with information about his ability ought to provide a better basis for job assignment than would either type of information alone. Stuit (53), in a report of research in the Bureau of Naval Personnel in World War II, stated that "Studies at elementary service schools showed that there was an appreciable amount of attrition among recruits assigned to service school training. It was discovered that much of the attrition was due to disappointment with, or lack of interest in, school work on the part of the trainees."

It has been stated by Crosby (22), "One of the most important problems in education today is that of measuring the motivating factors that contribute to success in school work." The present study sought the relationship between interest, as measured by the Minnesota Vocational Interest Inventory, and achievement grades in two fields of naval air technical training. The Navy schools considered were

the basic Aviation Electronics Technician and Electronicsman school and the basic Aviation Mechinist's Mate school which are a part of the Naval Air Technical Training Command at the Naval Air Station, Memphis, Tennessee.

It seemed that the prediction of success in air technical training could be improved by the possession of almost any additional information on the part of the person doing the predicting. If it were possible to possess some knowledge of the trainee's motivation in addition to his abilities, industriousness and performance, it might be possible to improve on the predictive ability offered by the present test scores of the Navy classification battery.

Failures in naval schools are costly in dollars and time spent in recruiting and training. It seemed reasonable that interests could be a determining factor in such failures. Men in basic technical schools are usually young and inexperienced; they have had no special training. Among them are many who probably do not fit Navy trades. If this is so, a test designed to sample interest relative to the Navy situation should prove predictive of success in training for Navy occupations. Bray (10) noted, "A classification interviewer spends a considerable portion of his time in attempting to pin down the interests of the

recruit. The recruit is asked whether he thinks he would like to be this, that, or the other kind of soldier or sailor. He is queried on his hobbies. He tells whether he enjoys mathematics, languages, sciences, shop, or other subjects in school. His interests are probed because they are believed determinents of his future performance."

Recruits are not selected for training, however, on the basis of choice alone. McCain and Schneidler (44) have reported, "Such preferences have been found to shift with passing fancies or whims, to be based on lack of information about the duty, and thus to contribute to high attrition rates in the schools and to serious losses in manpower."

Statistically reliable differences in interest obtained between ability levels would not only contribute to an understanding of the interests that were concomitant to satisfactory achievement but they would make information available which might be useful for instructional purposes in the Air Technical Training Command.

The Relationship Between Interests and Other Factors

If interest should correlate to any degree with achievement, it might be helpful to determine the relationships that exist between interests and other information which is careers. The recruit is asked whether he thinks he would like to be this, that, or the other kind of soldier or sailor. He is queried on his hobbies. He tells whether he enjoys mathematics, languages, sciences, shop, or other subjects in school. His interests are probed because they are believed determinants of his future performance."

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Statistically reliable differences in interests attained between ability levels would not only contribute to an understanding of the interests that were concomitant to satisfactory achievement, but they would make information available which might be useful for instructional purposes in the Air Technical Training Command.

The Relationship Between Interests and Other Factors

If interest should correlate to any degree with achievement, it might be helpful to determine the relationships that exist between interests and other information which is now utilized by the Navy to select men for air technical training. For example, if both ability to learn and interests were correlated appreciably with success in school, but correlated only slightly with each other, the ideal situation usually hoped for in test batteries would be obtained. Ability to learn and interest would have an independent contribution to make toward prediction of achievement. Or, if interest and mechanical aptitude showed a high correlation, the prediction of one on the basis of the other might be justified.

It might also be possible that some of the factors upon which selection for training is based may influence measured interests and may play a part in determining an individual's vocational interests.

At the present time, naval enlisted personnel are selected for aviation mechanics and aviation electronics training on the basis of a combination of aptitude test scores, civilian work experience, motivation, previous training and self-estimated interests. The information about each subject which was available for this study consisted of several Navy Basic Test Battery scores and certain personal information. The test scores included the following: General Classification Test, Arithmetical Reasoning Test, and Mechanical Aptitude Test. Personal

information included Navy rate, age, years of civilian education, and previous naval aviation training.

Procedures

This study attempted to determine the relationship between interests and achievement and the relationship between interests and several other factors in selection by analyzing the interest scores and personnel records of a group of eight hundred and nineteen Navy enlisted men who were in basic training schools for the Aviation Machinist's Mate rating and the Aviation Electronics Technician and Electronicsman ratings. Measurements of interest were obtained from scores made by the subjects with the Minnesota Vocational Interest Inventory. Measurements of ability were the scores made by the men with the Navy General Classification Test when they entered Navy recruit training. Achievement in the present study refers to training-school success as indicated by final grades assigned by the training schools. Stuit (53) has stated that "It is recognized that the measures of training school success need supplementation by measures of actual performance in the practical duties for which the school courses provide background or training. The relation between success in school and success on the job is not, in general, sufficiently close to permit a measure of

the one to substitute for a measure of the other. Nevertheless, the criterion of success in school has definite practical validity, since a person who fails a training program will not, ordinarily, be permitted to enter the duties for which the program is the official prerequisite."

To determine the interest-achievement relationship, ability was held constant by experimental means. For men of the same ability (GCT scores), interest scores were correlated with final grades. Interest scores were also correlated with achievement grades of the subjects representing each training school. Interest scores were correlated with ability scores and Navy Mechanical Aptitude Test scores.

It was originally planned to correlate interest scores with age, years of education and previous aviation training. A survey of the data, however, revealed that the majority of the subjects were nineteen to twenty-one years of age; that nearly all of the men were high school graduates; that previous aviation training was limited to the naval aviation preparatory school at the Naval Air Station, Jacksonville, Florida, and therefore, the correlations mentioned above were not computed because of the restricted range of the variables.

A description of the Naval ratings used in this study

will be of interest to persons not familiar with the Navy. The duties and responsibilities of each rating and a description of the training given at the basic schools will be found in Appendix I.

DEFINITIONS OF TERMS USED

Interest

Before interest can be dealt with, it must be expressed in some objective, quantitative way. Strong (51) points out three concepts of interest expression: (a) "A single expression such as 'I like arithmetic'", (b) "A general tendency toward a constellation of items, as when we state that a man has mechanical or scientific interests," and (c) "As the total score of an interest inventory, as a lawyer or a high masculine-femininity score." James (41) used attention as the main criterion of interest and this is still the definition of interests found in Warrens' Dictionary of Psychology.

The point of view of education today, taught by Rousseau, is that education comes from within, through the workings of natural instincts, and not through response to force. Flanagan (30) found that there was ample evidence that broad interests and values which could be utilized in increasing motivation for a specific type of assignment were present in Army Air Force personnel and could be used

to improve the effectiveness of the individual's efforts in one of the specific aviation fields, if he was assigned to it. Berdie (4) concluded that studies in interests are actually studies in motivation.

Beaumont and Macomber (2) state that "the development of an interest has its origin in successful adjustment to a situation and results in the desire to obtain similar satisfactions from similar situations." The interest of a man in a Navy rating, it might reasonably be expected, is greatly influenced by his previous successes or failures in the activities of that rating or in activities similar to those of the rating.

Strong (51) has said, "Experimentally, an interest is a response of liking," and "Interest is an aspect of behavior, not an entity in itself." Interests are activities that are liked or disliked, and most people seem to indicate their like-dislike reactions readily. Activities may be simple or complex; interest with an activity may be associated with the whole complex activity or merely with some of its parts. Activities may be grouped or classified many ways. Strong (52) has stated that "One criterion for groupings will rest upon abilities. Men who possess mechanical interests must differ in certain abilities from those with

few mechanical interests." It is possible to measure interests by noting expressed choice or by summarizing reactions to many activities that have been grouped or classified on some basis. Strong (51) has found that "Not much reliance can be placed on choice; considerable validity can be attached to the summarization of many choices on an interest inventory." Because interests are liked-disliked activities, they obviously are learned. Having learned to like an activity, it is possible later on to learn to dislike it and vice versa. The valuation, however, is in terms of what the person wants to do; only as the person changes are activities revalued. Carter (15) concluded that "Vocational interests are being interpreted and studied as aspects of personality, having implications for vocational success and satisfaction. Interests, so conceived, are not independent of other measures of emotional, social, and intellectual maturity."

Interests as reported in this study were expressed as the scores of an interest inventory.✓ This score was determined by the individual's responses to items having reference to occupations and to activities.

Measured Interests

A survey of the literature of vocational psychology

would seem to indicate that the measurement of interests has not kept pace with other developments. Until recent years, the significance of satisfaction with an occupation has tended to be overlooked in the emphasis on the concrete and tangible results of work. It is important to know how much of success or failure can be attributed to the worker or the student's interest in his task and the satisfaction he derives from it.

Bingham (5) gave four reasons for attempting to measure vocational interests: (a) To find out whether a person will probably like to do the work of the occupation in question; (b) to ascertain whether the personal relationships within the occupation will probably prove congenial; because "... more often than not, a person can learn to do best what interests him most;" and (d) "to draw a person's attention ... to possible fields of activity which might otherwise be overlooked."

It is generally recognized that a knowledge of an individual's abilities and aptitudes is vital to predicting success in a given situation. Dunlap (28) has stated that "these factors lack a great deal in giving the complete picture if the individual is to be directed where his efforts will have their optimum value. A knowledge of the interests

of each individual may be necessary. This factor exerts a strong influence upon an individual's success in a given task or in a group of closely related tasks."

There are two chief arguments, both supported by ample studies, against self-estimated interests in choosing an occupation. The first argument stresses the factors which interfere with a realistic choice; factors leading students to declare occupational choices too hard to reach. Williamson (64) noted some of these factors: " ... too early choice, parental influence, over-estimate of earning, and desire for social prestige ... all these factors may cause the choice of an occupation not consonent with abilities." He also pointed out that students with emotional problems are likely to choose goals without regard to aptitudes or genuine interests. It would appear that a person may possess occupational interests without being aware of them. A test or inventory is useful in discovering such a fact.

The second major argument calls attention to the frequent disagreements between self-estimated and measured interests. Crosby and Winsor (23) obtained results that indicated that interest inventories may probably be used quite profitably to supplement the student's own opinion of his interests." Bedell (3) argued that measured inter-

ests are more nearly valid than self-estimated interests although the latter are not necessarily without significance. Strong (51) supplemented this by saying, "Expressed choice must be replaced by carefully considered measures of the individual's abilities and interests."

Cronbach (21) stated that "Interest can rarely be determined adequately by a direct question," and that " ... Answers are often based on ignorance or superficial understanding of the activity."

THE PERMANENCE OF INTERESTS

A question of importance in the measurement of interests is that of the permanence of interests. If men in the Navy are to be aided in vocational choice by a knowledge of their interests, it is important to understand the nature and amount of change of interests.

Permanence means persistence in time without change. Stability has reference to the shifts from liking to disliking, and the reverse, that are found in individual interest items. Fryer (36) concluded that "there is a permanence or stability of interest, as indicated in every study, to a surprising degree. It is made clear that what have been one's vocational interests in the past are the foundation of one's present interests." Strong (52) suggested that the

persistence of interest patterns is due to the fact that the normal person, on the whole, changes very little with the years in his chief characteristics. The interests of boys and girls at 15 years of age are differentiated by the same activities to about the same degree as are the interests of adult men and women. This would seem to indicate that interests remain remarkably constant from fifteen years of age onwards. Strong (52) has reported that "it is relatively rare for one to discard a whole group of related activities for a new group" and that "the existing data support the belief that interests are far more persistent than is popularly believed." It also has been stated by Strong (51) that "The primary conclusion regarding interests of men between 25 and 55 years of age is that they change very little" and that " ... it must be realized that age and the experience that goes with age change an adult man's interests very little. At 25 years of age he is largely what he is going to be and even at 20 years of age he has acquired pretty much the interests he will have throughout life."

It is apparent from studies in which the same persons have recorded their interests on the Strong Blank on two occasions, separated by intervals of one to five years,

that the dominant interests persist. This is especially true of persons beyond the high school years. Strong (51) has shown that the chances of a "C" rating to change to an "A" rating or vice versa within a ten year period following administration to college seniors are nil. Similarly, the chances are extremely small for such changes to occur for high school juniors over a six year period.

The Effect of Training upon Vocation Interest Scores.

Another question of importance is whether training for an occupation or experience in a vocation have an effect upon vocational interest scores. After reviewing the evidence, Strong (51) concluded that "Vocational interests found among college students and to a lesser degree among juniors and seniors in high school cannot be attributed to formal training or experience in those pursuits. Hence, it appears, that the interest characteristics of occupational groups are present to a large degree prior to entrance into the occupation and so are presumably a factor in the selection of the occupation."

CHAPTER II

REVIEW OF THE LITERATURE

INTEREST MEASURING DEVICES

The construction and use of interest measuring devices is a rather recent development in the field of psychological testing. The real incentive leading to most of the work in the measurement of interest was the necessity of differentiating and classifying individuals on the basis of their interests. Discrimination has long been synonymous with validity in tests. However, discrimination and resulting classification exist on several different levels. It is one thing to measure one lawyer's interests; it is another to know whether those interests are characteristic of the legal profession. Or, it is very well to assume that mechanics and salesmen find their satisfaction in different fields. It would be reassuring, however, to establish that the pattern of interests is both universal in either occupation and at the same time clearly distinct from that of the other occupation.

Early History

Freyd (34), in 1921, began the task of attempting to

develop a standardized interest inventory by endeavoring to differentiate jobs on the basis of either social or mechanical interests. This work was the beginning of differentiation of men in one occupation from men in other occupations. Cowdery (20) selected items discriminating between physicians, engineers, and lawyers, without any assumption as to the nature of the three patterns of interest. His method consisted in contrasting percentage frequencies of like and dislike responses to his Interest Report Blank of one occupational group with the responses of the other two occupational groups pooled together. He then sifted out just those items which showed a significant difference in such percentages. The results were encouraging, and the method had proven successful. Fryer (36) has reported that Strong used Cowdery's method to still greater advantage when he first compared eighteen professions involving twelve hundred seventy-one individuals and later sixteen professions involving twenty-nine hundred and forty-four individuals.

Types of Interest Measuring Devices

Since 1921, several hypotheses of interest measurement have been developed. A first hypothesis was the information test of interests which attempted to measure the range of information in an occupational field, an educational subject, or the total environment. The underlying assumption was develop a standardized interest inventory by endeavoring to differentiate jobs on the basis of either social or mechanical interests. This work was the beginning of differentiation of men in one occupation from men in other occupations. Cowdery (20) selected items discriminating between physicians, engineers, and lawyers, without any assumption as to the nature of the three patterns of interests. His method consisted in contrasting percentage frequencies of like and dislike responses to his *Interest Report Blank* of one occupational group with the responses of the other two occupational groups pooled together. He then sifted out just those items which showed a significant difference in each percentage. The results were encouraging, and the method had proven successful. Fryer (26) has reported that Strong used Cowdery's method to still greater advantage when he first compared eighteen professions involving twelve hundred seventy-one individuals and later sixteen professions involving twenty-nine hundred and forty-four individuals.

Types of Interest Measuring Devices

Since 1921, several hypotheses of interests measurement have been developed. A first hypothesis was the information test of interests which attempted to measure the range of information in an occupational field, an educational subject, or the total environment. The underlying assumption was that the greater a person's interest in any particular field of activity, the more likely will he be to have acquired specific information in that field. Fryer (36) has noted that an early information test with the purpose of indicating breath of interests was Robinson's Range of Interest test prepared in 1916. Another test based on the information hypothesis was the O'Rourke Mechanical Aptitude Test, Junior Grade. Fryer (36) has stated that this test is a leading information test of mechanical interests. A more recent attempt to measure interests through information was the General Information Test used in the Army Air Forces in World War II and described by Guilford and Lacey (17).

Another approach was made through the process of free word association as in Wyman's (65) Free Association Test of Interests. Her study was limited to children and dealt with three special fields of interest reactions: intellectual, social, and activity interests. A third method of interest measurement had to do with learning. Burtt (13) relied on the assumption that one learns more easily that which is of greatest interest. A fourth procedure involved resistance to distraction founded on the hypothesis that distractability will be lower for interesting material than

for other material.

More recent measuring devices have explored a number of other hypotheses. Strong's (51) inventory was constructed around the central idea that the likes and dislikes of good workers in a given occupation will group themselves into a definite pattern not found in any other occupation. Kuder's (42) Preference Record is based on the concept that preferences for types of activities have vocational significance. A unique instrument was the Allport-Vernon Study of Values (1), which stressed evaluative attitudes. Some methods originated with the idea that interests are expressions of affective attitudes. Bingham's (6) Aids to the Vocational Interview aimed to draw out expressions of both vocational and avocational preferences and to insure that they were considered in their relation to other vital facts about a person.

The Structure of Interest Tests

The structure of interest tests has taken various forms. A very common form is the check list for likes, indifferences and dislikes. A second procedure is that of showing preferences between two opposite choices. A third form is forced-choice and requires an indication of the best liked and also the least liked among three alternatives.

order of preference from several statements is still another technique. A fifth device, added by Strong, contains methods for rating one's own attitudes.

The Use of Interest Tests

The principle use of interest tests today is in the field of guidance ✓ and vocational counseling.✓ Most interest tests are, in fact, interviews,✓ presenting the subject with a series of questions such as a counselor might otherwise ask.

THE MINNESOTA VOCATIONAL INTEREST INVENTORY

Introduction

Because of experience gained in World War II, it is generally recognized by the armed forces that in classifying men for military duty information about their interests might provide a valuable supplement to that obtained by interviews, vocational history or standardized tests of ability. It was desired by the Navy to determine the extent to which researches in interest measurement which have proven useful in vocational counseling in civilian life could be applied in the military services. The work was assigned, as Project N6ori-212, to Dr. Kenneth E. Clark at the University of Minnesota. Clark (18) undertook a research program, "designed to provide an instrument for indicating

the degree to which the recruit's interest patterns approximate those of established workers in each of a variety of occupations," for the sorts of occupations to which the young naval recruits are assigned. The first investigations studied civilian worker groups at the skilled trades level. Future investigations were planned with Navy rating groups.

Several paper and pencil tests of interests had previously been tried by the armed forces. The two most widely known which had been used with civilian groups were the Strong Vocational Interest Blank and the Kuder Preference Record. Clark (18) has stated that "One of the serious limitations of these instruments, however, is the inadequate coverage at the skilled and semi-skilled levels." The Strong Blank is designed primarily for professional groups and provides scoring keys only for carpenter, policeman and printer at the lower occupational levels.

Vocational counseling in the armed forces, as far as the measurement of interests is concerned, is complicated by other factors stated by Clark (18). He has noted, "For one thing, military terminology is strange to the newly inducted recruit. To ask for statements of job preferences in terms of job titles is therefore likely to be futile. To ask for a statement of preferences in terms of definite the degree to which the individual's interest patterns resemble those of established workers in each of a variety of occupations," for the sorts of occupations to which the young naval recruits are assigned. The first investigations studied civilian worker groups at the skilled trades level. Future investigations were planned with Navy rating groups.

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Vocational counseling in the armed forces, as far as the measurement of interests is concerned, is complicated by other factors stated by Clark (10). As he noted, "For one thing, military terminology is strange to the newly inducted recruit. He may find statements of job preferences in terms of job titles is therefore likely to be futile. He may fear a statement of preference in terms of definite types of activities is also likely to obtain information of doubtful value either from a civilian or military respondent. Even were such an approach considered desirable, it is likely that the high level of affect among recruits would lead them to state preferences in terms of assignments which either keep them closer to home, keep them in the continental United States longer, or either reduce or increase their likelihood of being assigned to combat duty." A questionnaire which could be scored in indicate the interests of an individual in terms of the known interest patterns of members of military occupational groups did not exist.

Construction of the Inventory

The Minnesota Vocational Interest Inventory was prepared to provide the information which would be required for an analysis of interest patterns. The inventory is based upon the idea that successful workers in a given occupation have a characteristic pattern of likes and dislikes which is different from that of workers in other occupations. It is assumed that a person having the same pattern of interests will find satisfaction in that occupation, but that one having dissimilar interests will not be happy in it. The second assumption necessary to the in-

ventory is that interests are fairly constant.

There are five hundred and seventy items in the questionnaire which are grouped in three's, making a total of one hundred and ninety triads. To complete the inventory, a respondent selects from each group of three items the one in which he has the greatest interest and the one in which he has the least interest, leaving one of the items blank. The approach used is thus a forced-choice. A person completing the inventory will mark three hundred and eighty items.

The items of the inventory were constructed from information derived from several sources. A large number of the items describe jobs or tasks making up parts of a job. Suggestions for such items were obtained from The Dictionary of Occupational Titles, and the Manual of Navy Job Classifications, (NavPers 15105) and similar materials. The remaining items described activities similar to those of item 34 of the inventory:

34 a. Write letters.
   b. Fix a leaky faucet.
   c. Interview someone for a newspaper story.

Items were grouped into triads in a random manner, although an attempt was made to keep the nature of the items within the same order of complexity in terms of the ordinary life mastery in that interests are fairly permanent.

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35 a. Write letters.
b. Fix a leaky faucet.
c. Interview someone for a newspaper story.

These were grouped into triads in a random manner, although an attempt was made to keep the nature of the items within the same order of complexity in terms of the ordinary life situation. Clark has found that this approach led to several difficulties, the most obvious being that the combination of forced choice and haphazard arrangement of items in groups produced many triads in which a decision is difficult. In spite of this difficulty, Clark (18) has stated, " ... that this method is still to be preferred to the more obvious type of choice that is made when a questionnaire's content is 'stacked.'" Rather meager experimental evidence was used to decide the types of items. Later studies are intended by Clark to determine the types of items which will work best in the situations where the inventory will be used.

In the early phases of his work, Clark's attention was directed to determining whether there were or were not appreciable differences in the interest patterns in different skilled-trade occupations. It was interesting to note that Strong (51) stated in 1943 that previous work had suggested that occupations in the lower socio-economic levels could not be differentiated from one another in terms of interests. Clark first gave the list of questions to members of eight civilian occupational groups and tabulated their responses. He then compared the responses to each item of the inventory of each occupational group with the average

percentage responses of the total group which he called the Tradesmen-in-General group. By this method, the existence of differences in interest patterns in different occupations was established.✓ A scoring key was then prepared to give each person a score reporting whether or not his responses are like or unlike those of a given occupational group.

The Preparation of Navy Scoring Keys

Clark (17) then turned his attention to utilizing the fact that a difference in interest patterns in occupational groups at the skilled trades level does exist and can be measured by the Minnesota Vocational Interest Inventory.✓ He applied his findings to the Navy problem of classification and assignment of persons who have not yet established themselves vocationally. Clark reasoned that if a convenient and reliable index of vocational interests was available, it would be feasible to select men for a specific type of training not only on the basis of their ability to learn but also on the basis of their likelihood of finding the work exciting and stimulating. He felt that such an instrument would be especially valuable in that its most valid application would be with those inexperienced new Navy recruits who possessed above average capacities for learning and whose ultimate contributions to the Naval es-

tablishment should be utilized.

The Vocational Interest Inventory was administered to a sizable number of men in several Navy rating groups. The responses of the men in each rating were compared with those of a sample of men representing a wide variety of skilled or semi-skilled trade occupations, the Tradesmen-in-General group. Whenever the responses of men in a rating were quite different from those of the Tradesmen-in-General group, then the item for which the difference was found was used in the scoring key for that Navy rating. A person who receives a high score on this key will have made responses very similar to the responses of the men in that rating group and not much like those of the Tradesmen-in-General group. Clark (17) reported that "Experience with vocational interest inventories in counseling, entrants to civilian occupations suggests that a person making such a high score would find interesting and congenial both the activities of the rating and his fellow workers in the rating."

The fact that interest test scores discriminate between men in various occupations is evidence of the worth of the interest measure. Perfect sorting into occupational groups is neither desired nor expected, since deviates may be found in every group. But if the vast majority of workers

in one occupation can be differentiated in their interest from the vast majority in another occupation, then the interest measure should provide a sound basis for vocational guidance. The most significant kind of data that is available to show the sorting job done by the Vocational Interest Inventory is the amount of overlap of distributions. Clark (17) suggested that "the most appropriate is that recommended by Tilton." (59) This index uses the mean ✓ and the standard deviation ✓ of each distribution to define two normal distributions. The percentage overlap is the percentage of scores made by one group which can be matched with scores in the other group. For example, with the two keys used in this study, the results as obtained by Clark (17) are shown in Table I.

The fact that the two groups presented in Table I have an important characteristic in common, namely, that they are groups of naval enlisted personnel, does not, however, prevent the emergence of differences in interest. Clark (17) stated that "these differences are fully comparable with those obtained with civilian groups by Strong" and that "The validity of these keys seems satisfactory in that they do a fairly good job of separating men of one rating from men of another."

TABLE I

AVIATION ELECTRONICS TECHNICIAN SCORING KEY MEAN, STANDARD DEVIATION, AND PERCENTAGE OVERLAPPING

Group	Mean	Standard Deviation	% Overlapping
AT *	34.9	13.45	---
AD **	2.8	15.59	27

AVIATION MACHINIST'S MATE SCORING KEY MEAN, STANDARD DEVIATION, AND PERCENTAGE OVERLAPPING

Group	Mean	Standard Deviation	% Overlapping
AD	18.2	6.1	---
AT	8.5	5.8	42

* "AT" is the Navy abbreviation for the Aviation Electronics Technician rating.

** "AD" is the Navy abbreviation for the Aviation Machinist's Mate rating.

The keys used in this study were developed by Clark using a civilian Tradesmen-in-General group rather than a Navy-Men-in-General group. Clark (17) believed that the "quality of the keys will improve as the point of reference is shifted to a Navy base, but that this shift will not produce any remarkable improvement in keys, since so much similarity exists ... between civilian and Navy groups in interest patterns."

The degree to which a test can be depended upon to measure the same thing each time it is administered is an important mark of its usefullness. Clark (17) reported test-retest reliability coefficients from .58 to .83 for seven Navy ratings. These reliability coefficients were obtained by administering the interest inventory to a group of ninety Vocational High School boys. Clark (17) states that "the results are not surprising when it is remembered that these reliabilities were obtained by scoring the blanks of fairly young men, training for entry into selected civilian trades, on keys for seven specialized Navy ratings."

THE INTEREST-ACHIEVMENT RELATIONSHIP

Besides tested intelligence and abilities there exist certain fundamental interests and attitudes which must be contributory to success. Such an assumption seemed just-

ified in attempting to account for the discrepancies that are often found between intelligence and achievement. Factor analysis may some day identify the components of success. In the meantime, many empirical findings indicate that two of these components will probably be ability and interest. Some work with interest measures has indicated that these measures do predict success, but other work contradicts.

Some studies of the relationship between interest and achievement have shown a low relationship, contrary to the expectation. To retain the hypothesis that interests are a factor in achievement needs some kind of support.

Literature on the Relationship between Interest and Achievement.

Turney (60) reported that "It seems clear that the two major factors in school achievement are intelligence on the one hand and motivation on the other," and that "the play of interests developed long before are probably a part of what we call motivation." Frandsen (32) suggested that "besides interests, several other motives -- mastery in general, social approval, ascendancy in competition for good grades, security, etc., are appealed to in all courses. And school marks are not sufficiently sensitive to detect the efforts of the interest motive on achievement when all these other motives are operating simultaneously with in-

terest." Strong (51) hypothesized that "Interests may not correlate to any great degree with achievement over a short period of time and yet may correlate significantly when achievement involves performance over a considerable period of time."

A study of scholarship grades with likes, dislikes and interests of college freshman by Langlie (43) obtained results that showed that there is a relationship between interest and achievement and that the relationship is significant enough to be of use to a vocational adviser. Crosby (22) found results that showed a positive relation between interest in certain scales of the Kuder Preference Record and achievement in some school subjects. Nemoitin (47) concluded that a substantial and marked relationship exists between interest and ability in high school courses. In his study, he assumed that achievement in school work was a measure of ability. Congdon (19) used the Cleeton Interest Test for student teachers. He concluded that measured interests were as valuable as intelligence scores for predicting success in student teaching. Thompson (56) found that interest patterns are related to the marks earned by students in dental school. Dayhaw (26) has stated that "When standardized interest inventories were added to the counselor's kit, it became evident that prediction of

achievement was sizably improved." Strong's (51) conclusion that "Interest is an indeterminate indicator of success" would seem to be the best conclusion that can be reached to date.

THE INTEREST-ABILITY RELATIONSHIP

Literature on the Relationship between Interest and Ability

Studies of the relationship between interests and ability demonstrate that the conclusion reached by Fryer (36) is still valid: "Specialized interests have little relation to specialized abilities." If abilities do influence measured interests, this influence apparently is not very great. Berdie (4) reported that no one factor, including ability, plays a large part in determining vocational interests, yet all the factors are related to interests to some extent. He stated that "As personality is a complex phenonema resulting from a multiplicity of conditions, so are vocational interests." Strong (51) presented correlations between intelligence and interest test scores and concluded that "Occupational interest scores correlate in the neighborhood of zero with intelligence."

Dayhaw (26) raised the question, "Which is desirable, high correlation or low correlation between interests and ability? Aptitude tests presumably measure potential ability, and they are valid only to a moderate extent; the

addition of interest measurements aims at improving prediction methods." It would seem safe to assert that the improvement would be helped by a low correlation. Fowler (31) reported that "Competent studies unanimously support the warning against drawing conclusions from the results of interest tests about abilities and other traits."

CHAPTER III

THE COLLECTION OF DATA

DESCRIPTION OF THE SAMPLE

The plan of the present inquiry required that the Minnesota Vocational Interest Inventory be administered to men in air technical training schools of the Navy. There are three levels of training from which the sample could have been drawn: preparatory, Class P; basic, Class A; and advanced, Class B. Training at one or more of these three levels is accomplished at six training activities at different geographical locations. The Class P school is located at the Naval Air Station, Jacksonville, Florida, and the three largest Class A and Class B schools are at the Naval Air Station, Memphis, Tennessee. These are the Aviation Electronics Technician and Electronicsman School, the Aviation Machinist's Mate School and the Aviation Structural Mechanic School. Through the aid of Dr. G. D. Mayo arrangements were made to administer the interest inventory to men in the Class A Aviation Electronics Technician and Electronicsman school and the Class A Aviation Mechinist's Mate School at the Naval Air Technical Training Command,

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Memphis, Tennessee. The classes selected, the dates of training and the date of administration of the interest inventory are shown in Table II.

The sample from which the data was drawn consisted of three hundred fifty-five enlisted personnel from the Aviation Electronics Technician and Electronicsman school and four hundred sixty-four men from the Aviation Machinist's Mate school. The only criterion for inclusion in the groups was that the necessary personal data on each subject could be obtained and that the interest inventory was filled out completely and in accordance with the instructions of the test booklet. Marine and Coast Guard trainees were not included in the sample because test scores of the Navy basic test battery were not available for these men.

The Aviation Electronics Technician and Electronicsman sample was made up of three hundred fifty-four men and one woman. The group ranged in age from eighteen to thirty. The mean age was 21.26 years. The years of civilian education of the subjects ranged from tenth grade to college graduates. Three hundred forty-three of the group were high school graduates; of these, ninety-two had completed one or more years of college education. Three hundred fifty-three were non-rated personnel; only two men were Navy

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The Aviation Electronics Technician and Electronicsman sample was made up of three hundred fifty-four men and one woman. The group ranged in age from eighteen to thirty. The mean age was 21.30 years. The years of civilian education of the subjects ranged from tenth grade to college graduation. Three hundred forty-three of the group were high school graduates; of these, ninety-two had completed one or more years of college education. Three hundred fifty-three were non-rated personnel; only two men were Navy

TABLE II

AIR TECHNICAL TRAINING SCHOOL CLASSES, DATES OF TRAINING, AND DATES OF ADMINISTRATION OF THE INTEREST INVENTORY

AVIATION ELECTRONICS TECHNICIAN AND ELECTRONICSMAN CLASS A SCHOOL TRAINING CLASSES

Class Number	N	Dates of Training	Date of Inventory
518B	96	3 Sept 1951 - 14 Mar 1952	6 Mar 1952
518C	88	10 Sept 1951 - 21 Mar 1952	13 Mar 1952
518D	85	17 Sept 1951 - 28 Mar 1952	20 Mar 1952
529A	86	24 Sept 1951 - 2 Apr 1952	27 Mar 1952

AVIATION MACHINIST'S MATE CLASS A SCHOOL TRAINING CLASSES

Class Number	N	Dates of Training	Date of Inventory
518A	125	10 Dec 1951 - 14 Mar 1952	5 Mar 1952
518B	115	17 Dec 1951 - 21 Mar 1952	12 Mar 1952
518C	113	24 Dec 1951 - 28 Mar 1952	20 Mar 1952
521A	111	31 Dec 1951 - 2 Apr 1952	26 Mar 1952

petty officers. Twelve of the group came to the school from the fleet or Navy shore activities. The remaining three hundred forty-three were received from the aviation preparatory school. Many of the trainees listed on the IBM answer sheet some experience in a civilian occupation. Civilian work experience ranged from farmer and electronic laboratory technician to pipe-fitter and commercial fisherman. Data about the Aviation Electronics Technician and Electronicsman population is presented in Table III.

The Aviation Machinist's Mate sample included four hundred sixty-four men whose ages ranged from eighteen to twenty-five years. The mean age was 20.09 years. The years of civilian education of the group had a range from eighth grade to college graduate. Seventy-three of the subjects had not finished high school; three hundred thirty-eight were high school graduates, and fifty-three had completed one or more years of college education. One man was a petty officer; all others were non-rated personnel. Four hundred sixty-two of the trainees entered the school after completing the aviation preparatory course; two men were received from Navy fleet activities. Table IV presents data about the Aviation Machinist's Mate sample used in this study.

TABLE III

AGE, YEARS OF EDUCATION, AND NUMBER OF WEEKS OVER THE COURSE OF THE AVIATION ELECTRONICS TECHNICIAN AND ELECTRONICSMAN SCHOOL SAMPLE

Age		Years of Education		Number weeks over course*	
Age	N	Grade	N	Weeks	N
18	1	10th	4	1	53
19	9	11th	8	2	24
20	87	12th	251	3	1
21	143	13th	71	4	2
22	70	14th	17	5	2
23	25	15th	1		
24	13	16th	3		
25	2				
26	1				
27	2				
28	1				
29	0				
30	1				

* Refers to the number of additional weeks required because of setbacks for a student to complete the training course.

TABLE IV

AGE, YEARS OF EDUCATION, AND NUMBER OF WEEKS OVER THE COURSE OF THE AVIATION MACHINIST'S MATE SCHOOL SAMPLE

Age		Years of education		Number weeks over course*	
Age	N	Grade	N	Weeks	N
18	22	8th	4	1	50
19	152	9th	7	2	16
20	155	10th	19	3	10
21	69	11th	43	4	2
22	43	12th	338	5	2
23	13	13th	26		
24	9	14th	20		
25	1	15th	1		
		16th	6		

* Refers to the number of additional weeks required because of setbacks for a student to complete the training course.

THE COLLECTION OF INFORMATION

The interest inventory answer sheets were received after the subjects had graduated from the training courses. Inventories of men in the electronics school were scored on the Aviation Electronics Technician key, and inventories of men in the machinist's school were scored on the Aviation Machinist's Mate key. These scoring keys were developed by Clark (17) from inventory responses of one hundred fifty-one Aviation Electronics Technicians and two hundred ninety-two Aviation Machinist's Mates. These men were drawn from Chief Petty officers and First class petty officers in the ship's company at the Air Technical Training Command.

The scoring of the answer sheets proved to be a lengthy process. It was necessary to score each paper by IBM machine four times. "Plus" and "minus" items had to be scored separately for each side of the answer sheet before the interest inventory score could be determined. Only two answer sheets proved useless; one was filled in on just one side and the other was filled in for every item of the inventory.

The number of items, plus and minus, in each scoring key will be of interest. The highest score obtainable is the total of plus items, assuming that an individual made

all of the plus-scored responses, and none of the minus-scored responses. The lowest possible score is the number of minus items, assuming that a person selected all minus-scored responses without selecting any plus responses. The maximum possible range of scores is 161 for the Aviation Electronics Technician key and 54 for the Aviation Machinist's Mate key.

The Aviation Electronics Technician key consists of eighty-three "plus one point" items and seventy-eight "minus one point" items. The Aviation Machinist's Mate key is made up of thirty-four "plus one point" items and twenty "minus one point" items. It is important to note that the number of items in each key may affect the reliability and validity of that key. Clark (17) has reported that "Too small a number of items will produce a key which is not stable enough to use for classification purposes. Too large a number has, in previous studies of this project, produced a key which does not discriminate well between members and non-members of an occupational group."

The other information and data necessary for this study was obtained from duplicate IBM permanent record cards on the subjects. These cards are maintained on each man attending an air technical training school and record the following information:

(a) School code

(b) Class number

(c) Service number

(d) Name

(e) Rate abbreviation

(f) Branch and class of service

(g) Year of birth

(h) Source

(i) General Classification Test score

(j) Arithmetical Reasoning Test score

(k) Mechanical Aptitude Test score

(l) Clerical Aptitude Test score

(m) Years of education

(n) Final average assigned by the training school

(o) Rank standing in class

(p) Status

(q) Number of weeks over the course

(r) Setbacks

Test scores, final averages, and other information were obtained readily from these cards.

CHAPTER IV

ANALYSIS OF DATA

PROCEDURES

The present report was concerned with an analysis of the scores made on the Minnesota Vocational Interest Inventory by men in two Navy air technical training schools and the achievement grades assigned to those men by the training schools. In order to determine the relationship between interest and achievement, ability as measured by the Navy General Classification Test was held constant. For men of the same ability (GCT scores), interest scores were correlated with final achievement grades. The ability groupings, their size, the correlations between interest and achievement scores, and the mean scores, standard deviations and ranges of the interest and achievement distributions are presented in Table V and Table VI.

General Classification test scores for men in the Aviation Electronics Technician sample ranged from 49 to 77. The mean score of the distribution was 63.64 and the standard deviation was 5.16. For men in the Aviation Machinist's school, General Classification test scores ranged from 38 to 73. The mean score was 59.50 and the standard

TABLE V

AVIATION ELECTRONICS TECHNICIAN AND ELECTRONICSMAN SAMPLE
CORRELATIONS BETWEEN INTEREST SCORES AND ACHIEVEMENT SCORES
MEAN SCORES, STANDARD DEVIATIONS, AND RANGES OF INTEREST AND ACHIEVEMENT DISTRIBUTIONS

			Interest Scores			Achievement Scores		
GCT Scores	N	r	M	SD	Range	M	SD	Range
49 - 56	35	-.05	23.15	14.30	-2 to 48	74.50	4.46	66.40 - 84.69
57 - 59	42	.16	19.0	12.50	-7 to 48	73.78	3.64	66.25 - 83.50
60 - 62	64	.26*	25.55	15.75	-12 to 64	74.74	4.52	66.82 - 86.68
63 - 65	72	.10	25.90	13.85	-1 to 52	75.92	4.13	68.65 - 86.01
66 - 68	69	.31**	24.45	13.80	-11 to 51	75.34	4.98	64.65 - 88.75
69 - 77	72	.21	26.25	12.50	-4 to 50	78.00	4.56	67.90 - 88.93
49 - 77	355	.21**	24.95	14.0	-12 to 64 -78 to 83	75.62	4.64	66.40 - 88.93

* Significant at the 5 % level   ** Significant at the 1% level

TABLE VI

AVIATION MACHINIST'S MATE SAMPLE
CORRELATIONS BETWEEN INTEREST SCORES AND ACHIEVEMENT SCORES
MEAN SCORES, STANDARD DEVIATIONS, AND RANGES OF INTEREST AND ACHIEVEMENT DISTRIBUTIONS

			Interest Scores			Achievement Scores		
GCT Scores	N	r	M	SD	Range	M	SD	Range
38 - 50	25	-.01	11.06	5.64	1 to 18	74.10	5.94	64.17 to 85.48
51 - 53	38	.41**	7.14	6.36	-3 to 21	75.18	6.14	66.67 to 91.83
54 - 56	52	.32*	10.42	6.58	-5 to 22	75.04	5.22	64.89 to 86.64
57 - 59	101	.29**	10.58	5.86	-8 to 23	75.43	5.16	62.79 to 86.41
60 - 62	119	.62**	9.46	6.88	-7 to 25	76.08	4.62	65.24 to 88.18
63 - 65	62	.22	10.18	6.88	-4 to 25	77.04	5.06	66.27 to 87.44
66 - 73	67	.41**	10.40	7.02	-4 to 23	79.24	5.32	66.71 to 91.63
38 - 73	464	.31**	9.92	6.68	-8 to 25	76.10	5.40	62.79 to 91.83

* Significant at the 5% level ** Significant at the 1% level

deviation was 5.54. An interval of three was selected for the General Classification test score distributions in order to provide a sizable N for each ability grouping. Because of the number of cases which were available at the ends of the distributions, men in the Aviation Electronics sample with GCT scores from 49 to 56 and from 69 to 77 were grouped together. With the Aviation Machinist's population, men with GCT scores from 38 to 50 and 66 to 73 were grouped together.

Correlation coefficients were also calculated between the following variables: interest and achievement scores, interest and General Classification test scores, interest and Mechanical Aptitude test scores, and General Classification test scores and achievement grades.

RESULTS - AVIATION ELECTRONICS TECHNICIAN SAMPLE

With ability held constant, the correlations between interest scores and achievement grades ranged from -.05 to .31 for the aviation electronics technician and electronicsman sample. Six product-moment correlation coefficients were obtained; five of these were positive and two coefficients were significant at the five per cent level. The mean correlation coefficient for the six ability groupings was .19, which is significant at the one per cent level. If

the ability groupings at the ends of the GCT distribution are notconsidered, the N is reduced to 24~~8~~7 and the mean r is increased to .21. The statistical procedure to obtain a mean correlation coefficient consisted of averaging the several coefficients by means of the "z" transformation of Fisher. The "z" values were weighted in accordance with the size of the N of each ability grouping. The tables used in transforming to "z" and converting the mean "z" to "r" have been given by McNemar (45).

The interest inventory scores for the sample ranged from -12 to 64. The mean score of the distribution was 24.95 and the value of the standard deviation was 14.0. These values compare favorably with the mean score of 34.9 and the standard deviation of 13.45 for the aviation electronics technician scoring key reported by Clark (17) when it is remembered that Clark's values were obtained from a sample of rated and experienced electronic's personnel. Achievement grades ranged from 64.65 to 88.93 with a mean of 75.62 and a standard deviation of 4.64. Mechanical Aptitude test scores ranged from 32 to 73 with a mean score of 58.87 and a value of 6.99 for the standard deviation.

The correlation coefficient between interest scores and achievement grades without partialing out ability was the ability groupings at the ends of the two distributions are not consistently. the d is reduced to .046 and the value r is increased to .23. The statistical procedure to obtain a mean correlation coefficient consisted of converting the several coefficients by means of the "z" transformation of Fisher. The "z" values were weighted in accordance with the size of the N of each ability grouping. The tables used in transforming to "z" and converting the mean "z" to "r" have been given by Peatman [45].

The Lambert inventory scores for the sample ranged from -11 to 69. The mean score of the distribution was 29.63 and the value of the standard deviation was 16.9. These values compare favorably with the mean score of 34.9 and the standard deviation of 13.45 for the original standardization population as reported by Lambert [47] when it is remembered that Lambert's values were obtained from a sample of rated and experienced elementary school personnel. Achievement grades ranged from 69.46 to 96.83 with a mean of 79.26 and a standard deviation of 4.64. Mechanical Aptitude test scores ranged from .33 to 11 with a mean score of 73.87 and a value of 6.88 for the standard deviation.

The correlation coefficients between Lambert scores and achievement grades without partialing out ability was

.21. The relationship between interest scores and ability was indicated by a correlation coefficient of .09. The corelation between interest scores and mechanical aptitude test scores was .04. The correlation between General Classification Test scores and achievement grades was .22.

RESULTS - AVIATION MACHINIST'S MATES SAMPLE

For the aviation machinist's mate sample, correlations between interest scores and achievement grades, with ability held constant, ranged from -.01 to .62. Seven product-moment correlation coefficients were obtained; one was negative and five were significant at the one or five per cent levels of significance. The mean correlation coefficient for the total sample was .39. When the ability groupings at the ends of the General Classification test distributions are not included the mean r is increased to .41 with an N of 372.

Interest scores had a range from -8 to 25 with a mean score of 9.92 and a standard deviation value of 6.68. Clark (17) has reported a mean score of 18.2 and a standard deviation of 8.1 for the Aviation Machinist's Mate scoring key. The achievement grades ranged from 62.79 to 91.83 with a mean of 76.10 and a standard deviation of 5.40. Mechanical Aptitude test scores ranged from 32 to 71; the mean

score was 54.49 and the value of the standard deviation was 7.65.

The correlation coefficient obtained between interest inventory scores and achievement grades without partialing out ability was .31. The correlation between interest scores and General Classification Test scores was .04. The relationship between interest and mechanical aptitude was indicated by a correlation of .32. The correlation coefficient between General Classification test scores and achievement grades was .25.

scores was 38.52 and the value of the standard deviation was 7.85.

The correlation coefficient obtained between Interest Inventory scores and achievement grades without partialling out ability was .11. The correlation between Interest scores and General Classification Test scores was .14. The relationship between interest and mechanical aptitude was indicated by a correlation of .12. The correlation coefficient between General Classification Test scores and achievement grades was .25.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the relationship between interest as measured by the Minnesota Vocational Interest Inventory and achievement as indicated by final averages in air technical training in the Navy. A secondary aim was to determine the relationship between the subjects' interest in the Navy rating for which they were in training and ability as measured by the Navy General Classification test, and the relationship between interest and mechanical aptitude as measured by the Navy Mechanical Aptitude test. The Minnesota Vocational Interest Inventory was administered to three hundred fifty-five enlisted personnel in four classes of the Aviation Electronics Technician and Electronicsman school and to four hundred sixty-four men in the Aviation Machinist's Mate school at the Naval Air Technical Training Command, Memphis, Tennessee. Data has been presented to show the relationship obtained between interest scores and achievement grades when ability was held constant; the relationship between interest scores and achievement grades for the total sampling

from each school; the relationship between interest and ability; and the relationship between interest and mechanical aptitude.

It was found that there appears to be a relationship between interest and achievement and that the relationship is positive and significant. The correlation coefficient obtained for the Aviation Electronics Technician sample would seem to indicate that the relationship is definite but small. For the Aviation Machinist's Mate sample, there was a moderate correlation which would seem to indicate a substantial relationship.

The failure of the interest scores to correlate more highly with the achievement scores could have been due to the restricted range of the achievement grades. McNemar (45) has noted that if a sample is drawn from a group "which is restricted in range with regard to either or both variables, the correlation will be relatively low." Only men who had successfully completed the training courses and who had graduated from the schools were included in the sample. It might be reasonably expected that if the sample had included all men who entered the training schools, the correlation would have been larger.

It is to be remembered that in the present inquiry, interests were measured after the subjects had completed

a large part of the training courses and not before they entered the schools. The results suggest that the interest inventory may have considerable validity in educational guidance in the Navy for selecting groups differing markedly in achievement, providing that similar results may be obtained previous to the taking of the training courses.

It is important to note that the interest inventory is not ready for Navy use, primarily because of the limited number of Navy scoring keys now available. It would seem that if the present form of the interest test were extended and refined, it could be used to increase materially the accuracy of prediction of future academic success in naval air technical training.

Since interest scores based upon a relationship with a Navy occupation have been shown to have definite relationships with air technical training subjects when achievement grades are used, it seems that scales for scoring the Minnesota Vocational Interest Inventory should be devised for the training courses in air technical training. It would seem logical to think that if interest scores based upon a criterion, such as the occupational criterion, have some relationship with academic success that interest scores obtained from a scale made directly for a criterion, such as

success in a training course, will have a greater relationship.

The results tend to reinforce the main implication of the study; namely, a measure of interest is essential to adequate prediction of achievement in air technical training school work. It may well be that a combination of measures of interest with measures of ability will provide a more adequate means for predicting training school achievement than measures that are now available. It would seem that prediction cannot be made of success on the basis of high interest scores alone, but that judgments need to be based on a full inventory of pertinent personal data, of which evidence of interest is only one part.

The results appear to indicate that interests as measured by the interest inventory do not bear a relationship to ability as measured by the Navy General Classification test. There also seems to be no significant relationship between measured interests of Aviation Electronic's trainees and mechanical aptitude as measured by the Navy Mechanical aptitude test. There is, however, a significant relationship between the measured interests of Aviation Machinist's Mate trainees and mechanical aptitude. It would seem that this relationship might be caused by the

nature of the aviation machinist's scoring key and by the nature of the population studied.

There seems to be no evidence in the results to show why a higher correlation coefficient was obtained between interests and achievement with the Aviation Machinists' sample. Several factors undoubtedly contribute to this trend, but prominent among them are probably the following: the Aviation Machinist's Mate rating is possibly less skilled an occupation than the Aviation Electronics Technician rating, and the Aviation Machinist's training involves less classroom work and theoretical knowledge than does the Aviation Electronics Technician training.

Conclusions

The following conclusions have been made from the data available for this study and from the results which have been obtained:

1. With the population used in this study, there appears to be a relationship between interests as measured by the Minnesota Vocational Interest Inventory and achievement in air technical training in the Navy. The relationship is positive and significant.

2. It appears that prediction of success in an air technical training course can be improved by the possession

of knowledge of a man's interest in a Navy occupation.

3. Measured interests of naval air technical training students seem to have no significant relationship with ability to learn as measured by the Navy General Classification Test.

4. The measured interests of Aviation Electronics Technician and Electronicsman trainees do not correlate significantly with mechanical aptitude as measured by the Navy Mechanical Aptitude Test. The measured interests of Aviation Machinist's Mate trainees tend to have a small but significant relationship with mechanical aptitude.

5. Men who are in air technical training schools appear to have interests in the rating for which they are in training that are similar to the interests of experienced men in those ratings.

Recommendations

The results of this study suggest several lines along which further research in the field of interests might profitably be pursued.

1. That studies similar to the present inquiry should be made with future groups in the various air technical training schools. It is believed that the interest inventory should be administered to men while they are at the

aviation preparatory school. The interest inventory should be scored on keys for each rating for which training is available. The scores of the inventory should be weighted with other test scores of the Navy basic test battery, and this information should assist the classification officers in assigning men to Class A schools. Studies of these men should be made upon their graduation from the training courses.

2. That consideration be given to the development of scoring keys made directly for a criterion such as success in a training course.

3. That follow-up studies be made of graduates of air technical training schools to determine the relationship between interests and success in Navy occupations as well as between interests and success in training.

APPENDIX I

DESCRIPTION OF NAVAL RATINGS AND TRAINING COURSES

The material of this appendix is cited from the United States Navy Occupational Handbook (63) and from Curriculum Outlines for Class A training schools (24) (25) of the Naval Air Technical Training Command, Memphis, Tennessee.

I. AVIATION ELECTRONICS TECHNICAN

Duties and Responsibilities

Aviation Electronics Technicians maintain, adjust, test, install, and repair all air-borne radio, radar, loran, radio altimeter, and electronic fire control equipment. In addition, they must understand the construction and design of naval aircraft to the point that their work will not endanger the over-all efficiency and safety of the aircraft.

Some of the duties of Aviation Electronics Technicians are:

(1) Maintenance: Remove, clean, service, repair, calibrate, install, and otherwise maintain aviation electronics equipment.

(2) Power Discrepancies: Detect, localize, and correct discrepancies in aircraft electrical power supply used for electronics, including direct and alternating current generators and reverse current cut-outs.

(3) Preflight Checks: Perform preflight checks on radio, radar, and other electronic equipment used in aircraft including tube testing, voltage measurements, frequency measurements, and bench alignment.

(4) Calibration: Calibrate and check range accuracy of radar equipment.

(5) Measurements: Make sensitivity measurements of aviation electronic equipment.

(6) Antennas: Disassemble and reassemble antenna equipment. Test for insulation and grounds, make certain antennas are free from dirt and not broken, and make necessary repairs.

(7) Trouble Shooting: Diagnose trouble in aircraft electronic circuits by means of standard service equipment and circuit analysis.

(8) Blue Prints: Use blueprints, drawings, and diagrams to install and maintain aircraft electronic equipment.

(9) Performance Records: Make reports and keep records of the performance and maintenance of electronics equipment.

(10) Publications: Use publications, technical instructions, and parts catalogs in conducting maintenance procedures.

Aviation Electronics Technicians acquire special skills and knowledge of the following:

(1) Names, types, nomenclature of parts, and uses of electrician's hand tools used in the adjustment and maintenance of aviation electronic equipment.

(2) Wiring diagrams and schematic drawings with their accompanying symbols for electronic circuits, equipment, and associated parts.

(3) Purpose and use of standard naval testing and measuring equipment used for aviation electronics such as vacuum tube tester, volt ohmmeter, ammeter, voltmeter, milliammeter, frequency meter, and oscilloscopes.

(4) Theory, performance, details of installation, purpose, and use of electronic equipment installed in planes.

(5) Knowledge of electricity, in respect to alternating and direct current, and the laws which apply.

(6) Theory and types of batteries, motors, generators, transformers, inductances, voltage regulators, selsyn and amplidyne drive system dynamotors and electrical power systems used in aircraft.

(7) Mathematics including proportion, albegra, triangles, powers of ten, logarithms, trigonometry, advanced algebra, and complex alternating and direct current problems in series and parallel networks.

(8) Safety precautions to be observed in working in or

near airplanes and in the operation of high voltage equipment.

(9) Technical booklets and instruction manuals used for maintaining and repairing aviation electronic equipment.

(10) Records, logs, and reports required for electronic equipment.

Work Assignment

Aviation Electronics Technicians may be stationed wherever naval aircraft are based. This includes aircraft carriers, battleships, cruisers, naval air stations, and land operating bases. It is the basic policy of the Navy to rotate its personnel between sea or advanced base assignments and assignments within the continental limits.

Qualifications and Preparation

A high school education is desirable for personnel who wish to become Aviation Electronics Technicians. They must achieve satisfactory scores on the Navy tests enumerated in the following section on "Training Given."

School courses in algebra, trigonometry, physics, electricity, radio, and mechanics are desirable. Experience as an amateur radio operator or in civilian electrical trades is helpful.

Training Given

Upon entering the Navy all personnel are sent to a Recruit Training Center for fourteen weeks of indoctrination and basic training, guidance, and classification. Upon completion of this period, selected candidates attend the Airman School, which lasts for eight weeks.

Candidates for the School for Aviation Electronics Technicians are then selected from among the graduates of the Airman School. Such selection is based on the desire of the candidates, their aptitude for the work, and their achievement in Airman School.

Personnel assigned to aviation duty, but who at this time are not selected for school training, will have the opportunity to obtain training on the job and through the study of training course manuals. Such personnel may be selected at a later date for training at the Aviation Electronics Technicians School, provided their aptitude for the work justifies the training.

The Aviation Electronics Technician and Electronicsman School provides for twenty-eight weeks of training in the following areas:

Phase One - International Morse Code (50 hours).

Phase Two - Electronics Fundamentals (280 hours).

Phase Three - Transmitter Fundamentals (200 hours).

Phase Four - Communication Systems (160 hours).

Phase Five - Radar Electronic Fundamentals (270 hours).

Phase Six - Operational Maintenance Training (80 hours).

Phase Seven - Flight Operations (80 hours).

II. AVIATION ELECTRONICSMAN

Duties and Responsibilities

Aviation Electronicsmen operate, adjust, test, and perform routine maintenance checks and make minor repairs to electronic equipment normally installed in naval aircraft including radio, radar, loran (system of navigation based upon two radio signals), and radio altimeters. They act as aircraft communicators, sending and receiving radio messages both by key and voice. They must also be proficient in using flashing light and in reading semaphore and flag-hoist signals in order to communicate between ships and planes. They assist in the navigation of planes by taking bearings with radio direction finders.

Some of the more specific duties of Aviation Electronicsmen are:

(1) Operations: Operate radio direction finders and loran, radio transmitters and receivers, radar, and electronic fire control and bombing equipment.

(2) Communications: Conduct communications aboard aircraft in respect to sending and receiving radio messages by International Morse Code, voice radio, and flashing light; encode and decode messages.

(3) Maintenance: Calibrate, clean, and perform routine maintenance checks on all electronic equipment in aircraft.

(4) Test Equipment and Measurements: Use test equipment such as volt-ohmmeters, voltmeters, ammeters, millammeters, frequency meters, tube testers, and oscilloscopes in making accurate measurements, adjustments, and alignments of electronic equipment.

(5) Records and Reports: Keep maintenance records of electronic equipment, radio watch logs (records of messages sent and received), and make reports pertaining to electronic equipment and communications.

(6) Drawings: Read and interpret schematic drawings relating to aircraft electronics.

Aviation Electronicsmen acquire skills and knowledge in the following:

(1) Names, types, nomenclature of parts, and uses of hand tools used to perform basic maintenance and checks on electronic equipment.

(2) Terms used and names of major structural assemblies contained in naval aircraft.

(3) Theory and principles of flight.

(4) Meaning of symbols on wiring diagrams and blueprints relating to aircraft electronics.

(5) Operation and basic operating theory of aviation electronic equipment and accessories and the capabilities and limitations of equipment. Theory of radio wave propagation as it pertains to frequency, skip distance, effects of heavyside layer, and seasonal changes. Factors affecting the operation of electronic equipment with regard to noise elimination and precipitation static.

(6) Navigational radio equipment including the radio direction finder; basic principles of dead reckoning navigation (the process of determining the plane's position by using the course followed and distance traveled, taking into consideration such factors as the speed of the plane, wind drift, and compass error).

(7) Basic electricity and radio theory including Ohm's Law for simple circuits, both series and parallel; alternating and direct current; batteries, motors, generators, and transformers; and the theory of the operation of voltage regulators, dynamotors, converters, and aircraft power systems.

(8) Solution of practical problems in mathematics, us-

ing principles of proportion, algebra, advanced algebra, trigonometry, and logarithms; alternating current and direct current problems in series and parallel networks.

(9) Meanings of symbols on drawings and diagrams to indicate electronic circuits, equipment, and associated parts.

(10) Communication procedures such as the drafting of messages and calling and receipting for messages received on continuous wave (International M$_o$rse Code), voice radio, flashing light, and semaphore.

(11) Transmitting and receiving radio code, flashing light, and semaphore.

Work Assignment

Aviation Electronicsmen usually serve on aircraft carriers or at naval air activities. They may serve aboard battleships or cruisers. It is the basic policy of the Navy to rotate its personnel between sea or advanced base assignments and assignments within the continental limits.

Qualifications and Preparation

Personnel under twenty-six years of age who meet the physical qualifications for Combat Aircrewmen and who volunteer for aerial gunnery are preferred. They must achieve satisfactory scores on the Navy tests enumerated in the following section on "Training Given."

Desirable school courses include algebra, trigonometry, physics, electricity, radio, and typewriting. Experience in radio repair or aviation is helpful.

Training Given

Training given to Aviation Electronicsman trainees is the same as that given to Aviation Electronics Technicians.

III. AVIATION MACHINIST'S MATES

Duties and Responsibilities

Aviation Machinist's Mates inspect, adjust, test, repair, and overhaul aircraft engines. They also perform routine tasks such as lubricating, refueling, changing tires, warming up engines, and cleaning planes; and they assist in handling planes on the ground, in the water, and on board ship. When assigned as flight engineers (members of crews on the larger planes), they operate the engines, landing gear, wing flaps, and other controls and equipment of the aircraft.

Some of the more specific duties of Aviation Machinist's Mates are:

(1) Airplane Handling: Handle and service aircraft on the ground, in water, and on deck. Load and stow equipment. Secure aircraft by tying down and mooring. Make daily and pre-flight inspections. Clean windshields, enclosures,

and surfaces.

(2) Engines: Service, maintain, install, and repair engines. Remove, clean, test, and replace spark plugs and turbine nozzles. Adjust valve clearance, time magnetos, and make compression checks. Make engine changes.

(3) Propellers: Repair, remove, service, and install propellers and propeller accessories. Check balance, pitch, and track of propellers.

(4) Carburetors and Fuel System: Check carburetors and fuel systems for proper operation. Trace fuel lines; clean strainers and check valves and fuel cells for leaks or sediment. Remove, disassemble, clean, inspect, assemble, perform upkeep on, and install carburetors. Set up, operate, and maintain carburetor flow benches. Test flow, pressure, and operation of carburetors and water injection systems.

(5) Instruments and Accessories: Remove, service, and install pumps, magnetos, ignitiin coils, distributors, starters, generators, batteries, oil coolers, control panels, and flight and engine instruments.

(6) Flight Engineers: Perform duties involving testing and operating engines, controls, and other equipment. These duties are performed before flight and when taxiing, taking-off, climbing, flying, descending, landing, and stopping.

Aviation Machinist's Mates acquire the following knowledge and skills from their training and experience:

(1) Names and uses of common hand tools, shop power-driven tools, and measuring instruments used for engine and accessory maintenance and repair.

(2) Blueprints and wiring diagrams for ignition, fuel, cooling, lubrication, and power transmission systems.

(3) Proper methods of handling, mooring, tying down, loading, and storing equipment. Procedures for starting, warming up, testing, and stopping engines. Procedures for checking engines and accessories for malfunctioning. Methods and materials used for cleaning aircraft surfaces, enclosures, windshields, engines, and accessory parts.

(4) Theory of operation and construction of engines. Procedures for servicing, maintaining, and repairing engines including inspection, tests, and routine servicing. Operation of engines and auxiliary power plants for taking-off, climbing, and cruising under various loading and operational conditions.

(5) Hydraulic and electrical principles applied to propellers. Nomenclature of propellers and propeller accessories. Procedures for assembling, disassembling, storing, testing, and adjusting propellers. Methods for heat-treat-

ing, straightening, and testing strength of propellers.

(6) Procedures for checking, repairing, and servicing aircraft carburetors and fuel systems.

(7) Basic mathematics including arithmetic, elementary algebra, trigonometry, and geometry to solve problems pertaining to aircraft maintenance, fueling, loading, weight, and balance.

(8) Basic principles of the theory of flight and of the construction, weight, and balance of aircraft.

Aviation Machinist's Mates in the lower pay grades generally perform the more routine duties, while the men in the higher pay grades perform the more technical duties and instruct and supervise the others.

Work Assignment

Aviation Machinist's Mates may be assigned to carriers, battleships, cruisers, or seaplane tenders at sea, to naval air stations or other air activities ashore, and may be assigned to flight duty as members of air crews. It is the basic policy of the Navy to rotate its personnel between sea or advanced base assignments and assignments within the continental limits.

Qualifications and Preparation

Personnel who pass the physical examination for Combat Aircrewman (member of a plane crew) and who volunteer for

aerial gunner are preferred for this rating. They must achieve satisfactory scores on the Navy tests enumerated in the following section.

School courses in machine shop, automobile or aircraft engines, algebra, and geometry are of value. Experience in aircraft engine maintenance or automobile repair is helpful.

Training Given

Candidates are selected for the Aviation Machinist's Mate School from among the graduates of the Airman School. Such selection is based on the desires of the candidates, their aptitude for the work, and their achievement in Airman School.

The Aviation Machinist's Mates School provides for fourteen weeks of training in the following areas:

Phase One - Introduction to Engines (80 hours).

Phase Two - Typical Reciprocating Aircraft Engines - Current (40 hours).

Phase Three - Aircraft Power Plant Accessories and Systems (200 hours).

Phase Four - Aircraft Operations (160 hours).

Phase Five - Jet Power Plants (80 hours).

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Vocational Interest Inventory

The aim of this test is to show whether you would like or dislike the work in each of several Navy rates. This is not a test of intelligence or ability. It does indicate the degree to which your interests are like those of rated men in various Navy jobs.

On the following pages, you will find many interests listed. They are arranged in blocks of threes. You must make a choice in each block of the one thing you LIKE to do most, and of the one thing you DISLIKE to do most (or like to do least).

You are to indicate your choices on the separate IBM answer sheet. For the item you LIKE to do most, make a mark in the "L" (Like) column. For the item you DISLIKE to do most, make a mark in the "D" (Dislike) column. This leaves one of the three pairs of spaces blank.

For example: 34 a. Write letters
b. Fix a leaky faucet
c. Interview someone for a newspaper story

On the answer sheet:

	L	D
34 a	▮	
b		
c		▮

These marks indicate that the item "Write letter" is liked most, and that the item "Interview someone for a newspaper story" is disliked most, or liked least. Item b is then left blank.

Work rapidly. Begin with item 1. When in doubt, make the best guess you can about what you like most and dislike most. Be sure to make one mark in the "L" column and one mark in the "D" column for each block of three items. DO NOT MAKE ANY MARKS ON THIS BOOKLET.

1. a. Catch up on your correspondence.
b. Try to fix a kitchen clock.
c. Discuss your philosophy of life with someone.

2. a. Type a letter for a friend.
b. Play solitaire.
c. Take a broken lock apart to see what is wrong with it.

3. a. Solicit money for a community chest.
b. Check typewritten material for errors.
c. Install an electric meter box.

4. a. Tape a bruised ankle.
b. Operate a bookkeeping machine.
c. Solve mechanical puzzles.

5. a. Watch an appendicitis operation.
b. Attend a lecture on television.
c. Go to an exhibit of recent inventions.

6. a. String an aerial for a friend's radio.
b. Try to win someone over to your side in an argument.
c. Experiment with making candy without knowing the recipe.

7. a. Be an office manager.
b. Be a bookkeeper.
c. Be an artist.

8. a. Play a musical instrument.
b. Play tennis.
c. Work crossword puzzles.

9. a. Do clerical work.
b. Cook short orders.
c. Sew on buttons.

10. a. Write a newspaper column of advice on personal problems.
b. Compete in an athletic tournament.
c. Take part in a public speaking contest.

11. a. Work in a hospital.
b. Work as night watchman at a military supply depot.
c. Work in a textile factory.

12. a. Study chemistry.
b. Study stenography.
c. Study manual training.

13. a. Make a model train.
b. Repair a clock.
c. Make a radio set.

14. a. Be the cashier in a bank.
b. Be a radio announcer.
c. Be an electrician.

15. a. Listen to recordings of a symphony orchestra.
b. Play bridge.
c. Go to a track meet.

16. a. Repair electrical wiring.
b. Fix a clogged drain.
c. Check for errors in the co of a report.

17. a. Work in the control room o radio broadcasting studio.
b. Work in a dental laborator
c. Work at an information des

18. a. Be an electrical engineer.
b. Be an aeronautical enginee
c. Be a surgeon.

19. a. Perform laboratory experime
b. Work with electrical device
c. Make out shipping bills.

20. a. Operate a drill press.
b. Be a cook in a restaurant.
c. Take shorthand.

21. a. Transmit radio communicati using code.
b. Conduct research on the eff of drugs.
c. Sell calculating machines.

22. a. Do scientific research.
b. Write a novel.
c. Repair watches.

23. a. Tinker with a broken sewin machine.
b. Refinish an old piece of furniture.
c. Make a study of mental ills

4. a. Set type for a small newspaper.
b. Inspect clothing for damage and irregularities.
c. Plan menus.

5. a. Work on developing synthetic rubber.
b. Inspect machines to see that they are in good condition.
c. Put together the parts of a calculating machine.

6. a. Study architectural design.
b. Study sociology.
c. Study calculus.

7. a. Be a machine operator.
b. Be a bill collector.
c. Work as a paper hanger.

8. a. Conduct research on improving airplane design.
b. Work on the development of a lighter and stronger metal.
c. Do an experiment to prove the earth is round.

9. a. Run an elevator.
b. Be a correspondence clerk.
c. Work in a laboratory where optical lenses are made.

0. a. Leaf through an illustrated cook book.
b. Do addition problems in your head.
c. Practice hitting a punching bag.

1. a. Sell over-the-counter in a men's store.
b. Type letters.
c. Operate a simple drill press.

2. a. Be a grocer.
b. Be a printer.
c. Be a shop foreman.

3. a. Make drawings for a newspaper.
b. Check stock.
c. Make small repairs around the home or garage.

4. a. Write letters.
b. Fix a leaky faucet.
c. Interview someone for a newspaper story.

35. a. Take a course in biology.
b. Take a course in cost accounting.
c. Take a course in engine design.

36. a. Operate a precision lathe.
b. Overhaul an automobile engine.
c. Make a chemical analysis of a new toothpaste.

37. a. Make a new key to replace a broken one.
b. Add columns of figures.
c. Install an electric light switch.

38. a. Be an interpreter.
b. Be a railway conductor.
c. Be a welder.

39. a. Varnish a floor.
b. Learn to use a slide rule.
c. Repair a broken connection on an electric iron.

40. a. Fix a doorbell.
b. Make coffee.
c. Sort mail.

41. a. Study touch typewriting.
b. Study shop work.
c. Study business arithmetic.

42. a. Put a closet in order.
b. File cards in alphabetical order.
c. Make a pie.

43. a. Be a master mechanic.
b. Be a chemist.
c. Be a recreation director.

44. a. Fill drug prescriptions.
b. Operate an addressing machine.
c. Operate a printing press.

45. a. Tune a piano.
b. Cook a meal.
c. Change a tire on an automobile.

46. a. Install an electric light bulb socket.
b. Look for errors in the draft of a report.
c. Test water for purity.

47. a. Study blood smears under a microscope.
b. Take shorthand.
c. Make drawings of aeronautical parts.

48. a. Be a private secretary.
b. Be an explorer.
c. Be a radio equipment repair technician.

49. a. Study story writing.
b. Study building construction.
c. Study personnel administration.

50. a. Read gas meters.
b. Put tags and labels on merchandise.
c. Locate and replace shorted wires.

51. a. Study carpentry.
b. Study first aid.
c. Study welding.

52. a. Repair and refinish old furniture.
b. Operate a cash register.
c. Test radio tubes.

53. a. Be a fingerprint expert.
b. Be a weather forecaster.
c. Be the efficiency expert who systematizes shop procedure.

54. a. Set up the electrical equipment on a movie studio sound stage.
b. Draw the plans for a large bridge.
c. Make a chemical analysis of a new commercial product.

55. a. Rivet sheet metal.
b. Solve physics problems.
c. Read radio blueprints.

56. a. Build rowboats.
b. Make novelty toys.
c. Make linoleum block bookplates.

57. a. Be a mechanical engineer.
b. Be an auto repairman.
c. Be a machinist.

58. a. Be a salesman in a hardware store.
b. Be sales representative for a real estate office.
c. Be an insurance agent.

59. a. Set up your own photographic darkroom.
b. Build furniture for the law of your home.
c. Carve figures from wood.

60. a. Repair torn clothing.
b. Wash and polish an automobile
c. Adjust a carburetor.

61. a. Be a concert musician.
b. Be a photo engraver.
c. Be a surveyor.

62. a. Make machine tools.
b. Develop negatives in a photographic dark room.
c. Play the records for an all-night radio program.

63. a. Install electric switches.
b. Operate an office adding machine.
c. Drive a taxi.

64. a. Install a telephone.
b. Make a written report of a month's work.
c. Draw a detailed terrain map.

65. a. Take part in a debate.
b. Have your fortune told.
c. Play chess.

66. a. Teach mathematics.
b. Help young people select the vocations.
c. Do chemical research.

67. a. Work crossword puzzles.
b. Work mental arithmetic problem
c. Show a friend how to operate a jigsaw.

68. a. Be a secret-service man.
b. Write a book on modern music.
c. Make a study of flower arrangement.

9.
a. Inspect food for spoilage.
b. Wash dishes.
c. Fix a flashlight that will not light.

0.
a. Get a job selling chemical supplies.
b. Get a job as a telephone lineman.
c. Get a job as an office worker.

1.
a. Direct the work of a construction gang.
b. Sell office equipment.
c. Plan musical programs.

2.
a. Draw graphs and charts.
b. Operate a mimeograph.
c. Manage an office.

3.
a. Learn to play golf.
b. Learn to cook.
c. Learn to use a news camera.

4.
a. Take care of plants.
b. Paint water colors.
c. Help someone fix his income tax.

5.
a. Teach English.
b. Teach chemistry.
c. Teach arithmetic.

6.
a. Transmit radio messages on voice circuits.
b. Write a report.
c. Adjust automobile brakes.

7.
a. Inspect and repair an adding machine.
b. Operate a steam clothes presser.
c. Handle requisitions.

8.
a. Putter around in a garden.
b. Take part in an amateur contest.
c. Cook spaghetti.

9.
a. Repair damage to a tree after a storm.
b. Construct a cabinet according to a blueprint.
c. Install an electric buzzer system.

0.
a. Check the spelling of a list of names.
b. Patch a leaky roof.
c. Help load cartons onto a truck.

81.
a. Fix a wobbly table.
b. Retouch negatives.
c. Operate a moving picture camera.

82.
a. Arrange a pile of letters in order of the date received.
b. Scramble eggs.
c. Pack food products for shipping.

83.
a. Interview job applicants.
b. Supervise the erection of a bridge.
c. Plan a radio program.

84.
a. Write daily reports on the progress of a community chest drive.
b. Make charts for use by ship companies or airlines.
c. Help select equipment for a machine shop.

85.
a. Conduct research on the psychology of music.
b. Conduct research on the causes of earthquakes.
c. Figure out new schemes to get work done rapidly and efficiently.

86.
a. Be a court stenographer.
b. Be a lathe operator.
c. Be a vocational counselor.

87.
a. Operate an office comptometer.
b. Operate a power shovel.
c. Operate a precision machine.

88.
a. Freeze ice cream in a hand freezer.
b. Check copies of manuscripts to be sure they are correct.
c. Check for breakage in a shipment of phonograph records.

89.
a. Collect pipes.
b. Collect phonograph records.
c. Collect stamps.

90.
a. Build a fire in a fireplace.
b. Fix a noisy radiator.
c. Make half quantity of a given recipe.

91. a. Have charge of the care and up-keep of a turret lathe.
    b. Help with work to improve the efficiency of artificial limbs.
    c. Help with research on television.

92. a. Hang a large wall mirror.
    b. Read aloud to someone.
    c. Take the initiative in settling an argument between two people.

93. a. Regulate a watch.
    b. Translate a code message into words.
    c. Repair a broken zipper.

94. a. Be an office personnel manager.
    b. Be a skilled airplane mechanic.
    c. Be an animal doctor.

95. a. Make pottery.
    b. Measure cloth by the yard.
    c. Splice wire together.

96. a. Record readings from weather forecasting instruments.
    b. Collect coins from parking meters and record receipts.
    c. Keep records of community chest pledges.

97. a. Draw a series of comic strips.
    b. Design an airplane.
    c. Build models of ships.

98. a. Drive a large truck.
    b. Put new pockets in clothes.
    c. Adjust front wheel bearings.

99. a. Address envelopes.
    b. Try to find an error in a financial account.
    c. Help put out the fire in a burning building.

100. a. Pack breakable articles for shipping.
     b. Inspect cloth for defects or damages.
     c. Operate a sewing machine.

101. a. Be a hospital attendant.
     b. Be a bank teller.
     c. Be a tool maker.

102. a. Take still life pictures.
     b. Take news photographs.
     c. Practice golf shots.

103. a. Spend an evening meeting new people at a social club.
     b. Spend an evening just chatting with a group of friends.
     c. Go to a hockey game.

104. a. Read the sports page of a newspaper.
     b. Read the editorial page of a newspaper.
     c. Read the financial page of a newspaper.

105. a. Launder clothes.
     b. Bind books.
     c. Take care of a lawn.

106. a. Do a lot of reading.
     b. Write letters on business matters.
     c. Look up new words in the dictionary.

107. a. Belong to an amateur astronomy club.
     b. Belong to a bowling club.
     c. Belong to a debate club.

108. a. Take a course in salesmanship.
     b. Take a course in business law.
     c. Take a course in mathematics.

109. a. Get a job in a factory.
     b. Get a job in a retail store.
     c. Go to school.

110. a. Help campaign for donations for an orphanage.
     b. Work in an office.
     c. Set up machines for a woodworking shop.

111. a. Raise poultry.
     b. Repair shoes.
     c. Press clothes.

112. a. Take a machine apart and reassemble it to learn how it works.
     b. Assist the ambulance physician at the scene of an accident.
     c. Teach someone how to use a machine.

113. a. Play poker.
     b. Play basketball.
     c. Play checkers.

114. a. Take part in an amateur show.
b. Go on a canoe trip.
c. Play billiards.

115. a. Work in a factory.
b. Work at a desk.
c. Work outdoors.

116. a. Be introduced to a famous scientist.
b. Be introduced to a well-known movie star.
c. Be introduced to a prominent politician.

117. a. Interview job applicants.
b. Investigate the causes of mental ills.
c. Try out various types of sails on a model sailboat to see which works best.

118. a. Write an arrangement of a popular song.
b. Conduct a study of the causes of crime.
c. Help a friend who is discouraged.

119. a. Go to a large party.
b. Go to a small party.
c. Spend the evening with a friend.

120. a. Read a biography of Louis Pasteur.
b. Read an article on U. S. foreign relations.
c. Read about the history of the drama.

121. a. Wait on table.
b. Operate a knitting machine.
c. Broil club steak.

122. a. Go to a dance.
b. Go to a birthday party.
c. Go to the movies.

123. a. Lead a community sing.
b. Write in a diary.
c. Do some sketching.

124. a. Read a book on psychology.
b. Read a detective story.
c. Read a current best-seller.

125. a. Work behind a soda fountain.
b. Transcribe dictaphone records.
c. Check supplies received against a list of those ordered.

126. a. Learn to write a financial report.
b. Take a course in astronomy.
c. Take a course in public speaking.

127. a. Practice shooting at 100 yards with a rifle.
b. Read TIME MAGAZINE.
c. Read THE SCIENTIFIC MONTHLY.

128. a. Do woodcarving.
b. Collect phonograph records.
c. Keep a snapshot album.

129. a. Read detective stories.
b. Read book reviews in the newspaper.
c. Read the sports page in the newspaper.

130. a. Tell jokes to a group of friends.
b. Play a pin-ball machine.
c. Umpire a baseball game.

131. a. See a movie short about sports.
b. See a movie short about the F. B. I.
c. See a comedy movie short.

132. a. Be in charge of the tool room in a factory.
b. Be an office clerk.
c. Be a watchmaker.

133. a. Make furniture.
b. Tool leather.
c. Draw sketches of things or people around you.

134. a. Read about early musical forms.
b. Read about how an airplane is assembled.
c. Read an article about causes of disease.

35. a. Play poker.
b. Pitch horseshoes.
c. Go fishing.

36. a. Talk with an authority on engine design.
b. Talk with a well-known newspaper writer.
c. Talk with a prominent doctor about his medical experiences.

37. a. Read about social customs in different countries.
b. Read a book about electronics design.
c. Read about the discovery of a new painkilling drug.

138. a. Take care of mental patients.
b. Assist in a chemical laboratory.
c. Operate an office duplicating machine.

139. a. Be a statistician.
b. Be a professional athlete.
c. Be a lawyer.

140. a. Sell typewriters.
b. Grind lenses for telescopes.
c. Draw the illustrations for a magazine article.

141. a. Work to improve methods of reproducing pictures in color.
b. Work out a catalog system for the books in a library.
c. Think up new time-saving gadgets for use around the house.

142. a. Study care of the war-wounded.
b. Study accounting.
c. Study refrigeration and air conditioning.

143. a. Tailor men's clothes.
b. Read proof for a newspaper.
c. Inspect machinery for repair needs.

144. a. Assemble mechanical parts.
b. Fry liver and onions.
c. Sharpen machine drills.

145. a. Give "first aid" assistance.
b. Make deep-sea dives.
c. Keep accounting machines in repair.

146. a. Write feature stories for a newspaper.
b. Read reviews of recent books.
c. Work in a medical laboratory.

147. a. Study shorthand.
b. Study engineering mathematics.
c. Study foreign languages.

148. a. Operate a calculating machine.
b. File memoranda and circulars.
c. Transmit coded messages by radio.

149. a. Be a librarian.
b. Be a draftsman.
c. Be a salesman.

150. a. Repair radio equipment.
b. Build things from wood.
c. Sort mail in a post office.

151. a. Supervise a group of men working on an assembly line.
b. Keep case records for a doctor's office.
c. Build boats.

152. a. Play baseball.
b. See an educational movie.
c. Visit someone in the hospital.

153. a. Keep accounts.
b. Make maps.
c. Keep mailing lists.

154. a. Be a garage mechanic.
b. Be a professional musician.
c. Be a pharmacist.

155. a. Manage an office.
b. Repair a radio set.
c. Estimate the cost of manufacturing a new medicine.

156. a. Arrange music for an orchestra.
b. Take an inventory of supplies in a wholesale store.
c. Write an article for housewives on how to repair household appliances.

157. a. Decipher messages written in code.
b. Do blood chemistry in a medical laboratory.
c. Assist in research on automobile design.

158. a. Take photographs of your friends.
b. Write a popular article on how a Diesel engine works.
c. Plan a recreation schedule.

159. a. Be a draftsman.
b. Be a chef.
c. Be a physical therapist.

160. a. Study sheet metal pattern drafting.
b. Study machine computation.
c. Study physiology.

161. a. Operate a steam shovel.
b. Run a gas station.
c. Drive an automobile.

162. a. Be a sculptor.
b. Be a photographer.
c. Be a test pilot.

163. a. Set up a bookkeeping system.
b. Take apart a mechanical toy to see how it works.
c. Experiment with a home recording set.

164. a. Make a statistical study for a business concern.
b. Write an article on how machine tools are made.
c. Do research on the cause of cancer.

165. a. Be a supply-clerk.
b. Be a buyer of merchandise.
c. Be a laboratory technician.

166. a. Read a book on how to lead discussion groups.
b. Read a book about modern methods of bookkeeping.
c. Read about new uses for plastics.

167. a. Work in a laundry.
b. Develop improved recipes for baked goods.
c. Re-upholster an old davenport.

168. a. Listen to a talk concerning up-to-date shop appliances.
b. Listen to a talk on propaganda methods.
c. Listen to a talk on hospital procedure.

169. a. Be a food buyer in some large institution.
b. Manage an apartment building.
c. Run a service for people confused about their income taxes.

170. a. Go bowling with a friend.
b. Go to a movie by yourself.
c. Spend an evening with a crowd of friends.

171. a. Attend a lecture about experiments to improve airplane design.
b. Listen to a speech on current affairs.
c. See a famous ballet.

172. a. Be a physician.
b. Be a locomotive engineer.
c. Write novels.

173. a. Read about steel bridge design.
b. Read about system in the modern office.
c. Read an article on new uses of X-Ray.

174. a. Train a dog.
b. Listen to jazz recordings.
c. Look at new airplane designs.

175. a. Study the color effects in a famous painting.
b. Study photographs of a surgical operation.
c. Study the instrument panel of a bomber.

176. a. Be an expert on color photography.
b. Be an athletic director.
c. Be a certified public accountant.

177. a. Give the anesthetic during an emergency operation.
b. Work out new uses for old machine parts.
c. Keep accounts of money.

178. a. Take a blood sample.
b. Explain to someone how to fill out insurance application forms.
c. Fix a faulty light switch.

179. a. Be a professor of a foreign language.
b. Be an architect.
c. Be a psychologist.

180. a. Manage a cafeteria.
b. Keep personnel records and reports.
c. Write articles on hobbies.

181. a. Sing in a chorus.
b. Read detective stories.
c. Attend a newsreel theater.

182. a. Be a carpenter.
b. Be a telegraph operator.
c. Be a doctor's assistant.

183. a. Alphabetize cards.
b. Cut meat.
c. Varnish floors.

184. a. Mix pancake batter.
b. Install a hot water heater.
c. Take part in a military drill.

185. a. Go to a boxing match.
b. Go bicycling.
c. Go to a dance.

186. a. Be a professor of mathematics.
b. Be a writer.
c. Be a scientific research worker.

187. a. Spend an afternoon reading in the library.
b. Visit a famous medical research laboratory.
c. Visit famous art galleries.

188. a. Write the script for a radio program.
b. Talk before a group of people.
c. Take charge of a telephone switchboard.

189. a. Handle the advertising for a newspaper.
b. Keep correspondence in alphabetical order.
c. Make mechanical drawings.

190. a. Be a publicity director for a large concern.
b. Be a druggist.
c. Be a jeweler.

NAME ______ (LAST) (FIRST) (MIDDLE) DATE ______

SERVICE NO. ______ RATE ______

HOW LONG HAVE YOU HELD YOUR PRESENT RATE? ______ YRS. ______ MONTHS

SERVICE SCHOOL(S) ATTENDED 1. ______ 2. ______

1 ______	5 ______	9 ______
2 ______	6 ______	10 ______
3 ______	7 ______	11 ______
4 ______	8 ______	12 ______

SCORES

DATE OF BIRTH ______ AGE ______ SEX ______ (M OR F)

MAIN CIVILIAN OCCUPATION ______

YEARS OF EXPERIENCE IN MAIN CIVILIAN OCCUPATION ______

HIGHEST SCHOOL GRADE COMPLETED ______

SHIP OR STATION ______

U. S. NAVY VOCATIONAL INTEREST INVENTORY

NOTE: READ DIRECTIONS ON THE BOOKLET BEFORE MAKING ANY MARKS ON THIS SHEET.

BE SURE YOUR MARKS ARE HEAVY AND BLACK.
ERASE COMPLETELY ANY ANSWER YOU WISH TO CHANGE.

		L	D
1	a	☐	☐
	b	☐	☐
	c	☐	☐
2	a	☐	☐
	b	☐	☐
	c	☐	☐
3	a	☐	☐
	b	☐	☐
	c	☐	☐
4	a	☐	☐
	b	☐	☐
	c	☐	☐
5	a	☐	☐
	b	☐	☐
	c	☐	☐
6	a	☐	☐
	b	☐	☐
	c	☐	☐
7	a	☐	☐
	b	☐	☐
	c	☐	☐
8	a	☐	☐
	b	☐	☐
	c	☐	☐
9	a	☐	☐
	b	☐	☐
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10	a	☐	☐
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11	a	☐	☐
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12	a	☐	☐
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13	a	☐	☐
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14	a	☐	☐
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15	a	☐	☐
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16	a	☐	☐
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17	a	☐	☐
	b	☐	☐
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18	a	☐	☐
	b	☐	☐
	c	☐	☐
19	a	☐	☐
	b	☐	☐
	c	☐	☐
20	a	☐	☐
	b	☐	☐
	c	☐	☐
21	a	☐	☐
	b	☐	☐
	c	☐	☐
22	a	☐	☐
	b	☐	☐
	c	☐	☐
23	a	☐	☐
	b	☐	☐
	c	☐	☐
24	a	☐	☐
	b	☐	☐
	c	☐	☐
25	a	☐	☐
	b	☐	☐
	c	☐	☐
26	a	☐	☐
	b	☐	☐
	c	☐	☐
27	a	☐	☐
	b	☐	☐
	c	☐	☐
28	a	☐	☐
	b	☐	☐
	c	☐	☐
29	a	☐	☐
	b	☐	☐
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30	a	☐	☐
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31	a	☐	☐
	b	☐	☐
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32	a	☐	☐
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33	a	☐	☐
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34	a	☐	☐
	b	☐	☐
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35	a	☐	☐
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36	a	☐	☐
	b	☐	☐
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37	a	☐	☐
	b	☐	☐
	c	☐	☐
38	a	☐	☐
	b	☐	☐
	c	☐	☐
39	a	☐	☐
	b	☐	☐
	c	☐	☐
40	a	☐	☐
	b	☐	☐
	c	☐	☐
41	a	☐	☐
	b	☐	☐
	c	☐	☐
42	a	☐	☐
	b	☐	☐
	c	☐	☐
43	a	☐	☐
	b	☐	☐
	c	☐	☐
44	a	☐	☐
	b	☐	☐
	c	☐	☐
45	a	☐	☐
	b	☐	☐
	c	☐	☐
46	a	☐	☐
	b	☐	☐
	c	☐	☐
47	a	☐	☐
	b	☐	☐
	c	☐	☐
48	a	☐	☐
	b	☐	☐
	c	☐	☐
49	a	☐	☐
	b	☐	☐
	c	☐	☐
50	a	☐	☐
	b	☐	☐
	c	☐	☐
51	a	☐	☐
	b	☐	☐
	c	☐	☐
52	a	☐	☐
	b	☐	☐
	c	☐	☐
53	a	☐	☐
	b	☐	☐
	c	☐	☐
54	a	☐	☐
	b	☐	☐
	c	☐	☐
55	a	☐	☐
	b	☐	☐
	c	☐	☐
56	a	☐	☐
	b	☐	☐
	c	☐	☐
57	a	☐	☐
	b	☐	☐
	c	☐	☐
58	a	☐	☐
	b	☐	☐
	c	☐	☐
59	a	☐	☐
	b	☐	☐
	c	☐	☐
60	a	☐	☐
	b	☐	☐
	c	☐	☐
61	a	☐	☐
	b	☐	☐
	c	☐	☐
62	a	☐	☐
	b	☐	☐
	c	☐	☐
63	a	☐	☐
	b	☐	☐
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64	a	☐	☐
	b	☐	☐
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65	a	☐	☐
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66	a	☐	☐
	b	☐	☐
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67	a	☐	☐
	b	☐	☐
	c	☐	☐
68	a	☐	☐
	b	☐	☐
	c	☐	☐
69	a	☐	☐
	b	☐	☐
	c	☐	☐
70	a	☐	☐
	b	☐	☐
	c	☐	☐
71	a	☐	☐
	b	☐	☐
	c	☐	☐
72	a	☐	☐
	b	☐	☐
	c	☐	☐
73	a	☐	☐
	b	☐	☐
	c	☐	☐
74	a	☐	☐
	b	☐	☐
	c	☐	☐
75	a	☐	☐
	b	☐	☐
	c	☐	☐
76	a	☐	☐
	b	☐	☐
	c	☐	☐
77	a	☐	☐
	b	☐	☐
	c	☐	☐
78	a	☐	☐
	b	☐	☐
	c	☐	☐
79	a	☐	☐
	b	☐	☐
	c	☐	☐
80	a	☐	☐
	b	☐	☐
	c	☐	☐
81	a		
	b		
	c		
82	a		
	b		
	c		
83	a		
	b		
	c		
84	a		
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85	a		
	b		
	c		
86	a		
	b		
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87	a		
	b		
	c		
88	a		
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90	a		
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91 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	101 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	111 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	121 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	131 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	141 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	151 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	161 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	171 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	181 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
92 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	102 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	112 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	122 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	132 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	142 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	152 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	162 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	172 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	182 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
93 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	103 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	113 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	123 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	133 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	143 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	153 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	163 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	173 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	183 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
94 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	104 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	114 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	124 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	134 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	144 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	154 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	164 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	174 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	184 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
95 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	105 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	115 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	125 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	135 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	145 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	155 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	165 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	175 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	185 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
96 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	106 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	116 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	126 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	136 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	146 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	156 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	166 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	176 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	186 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
97 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	107 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	117 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	127 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	137 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	147 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	157 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	167 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	177 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	187 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
98 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	108 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	118 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	128 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	138 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	148 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	158 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	168 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	178 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	188 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
99 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	109 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	119 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	129 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	139 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	149 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	159 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	169 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	179 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	189 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞
100 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	110 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	120 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	130 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	140 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	150 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	160 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	170 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	180 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞	190 L D a ⁞ ⁞ b ⁞ ⁞ c ⁞ ⁞

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